REMARKS

Upon entry of this amendment, claims 1, 3-11, 13-15, and 17--20 will be pending in the application.

Rejection Under 35 U.S.C. § 103(a)

The Office Action rejected claims 1-20 under 35 U.S.C. § 103(a) as being unpatentable over McMillin; Brian et al. (US 6,013,155 A) in view of Rohrberg; Roderick (US 3,604,889 A).

Applicant respectfully traverses the rejection. Claim 1 and the claims dependent therefrom, are patentable under 35 U.S.C. 103(a) over McMillin; Brian et al in view of Rohrberg; and Roderick, because the cited combination does not establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness under 35 U.S.C. 103:

(A) The claimed invention must be considered as a whole;

(B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;

(C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and

(D) Reasonable expectation of success is the standard with which obviousness is determined.

Hodosh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

To establish obviousness, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). In determining the differences between the prior art and the claims, the question under 35

U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F. 2d 1530, 218 USPQ 871 (Fed. Cir. 1983).

Claims 1 and 3-8

Claim 1 claims a replaceable gas nozzle that is insertable in a gas distributor ring of a substrate processing chamber and that can be shielded within the chamber, the nozzle comprising a longitudinal ceramic body having a channel to direct the flow of the gas into the chamber. The ceramic body comprises a first external thread to mate with the gas distributor ring and a second external thread to receive a heat shield. A pinhole outlet is provided at the end of the channel to release the gas into the chamber. The pinhole outlet has a diameter d_o, and wherein the distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$.

McMillin et al. does not teach or suggest the language of claim 1 taken as a whole. As acknowledged by the Rejection, McMillin does not teach a gas nozzle comprising a ceramic body having a first external thread to mate with the gas distributor ring and a second external thread to receive a heat shield.

The Rejection relies on Rohrberg to make up for the deficiencies of McMillin et al.. However, Rohrberg should not be combined with McMillin, because Rohrberg teaches the art of inert gas welding torches and not the art of substrate processing in plasma chambers. The art of inert gas welding torches is non-analogous art to the art of processing a substrate in a substrate processing chamber. Welding torches are used in automotive industries, metal working shops, etc., which are heavy industries with dirty environments. A gas nozzle is used for a substrate processing chamber operated in a clean room of a semiconductor fabrication labs. Thus, gas nozzles used for welding torches do not have the same technical requirements as gas nozzles used in substrate processing chambers operated in a clean room of a semiconductor fabrication lab. One of ordinary skill in the art would not seek designs for

gas nozzles for substrate processing chambers, as claimed, from gas nozzle art describing welding torches. For example, welding torch nozzles may be designed to be structurally strong and to withstand rapid temperature changes. Further, the contamination levels in welding torch nozzle material is not exceedingly important. In contrast, gas nozzles for the substrate processing chambers have to have very low contaminant levels so as not to contaminate the substrate being processed in the chamber. The gas nozzles also need reduced out-gassing requirements to be used in the low pressure environments of semiconductor processing chambers. Thus, Rohrberg is non-analogous art and should not be used in combination with McMillin et al..

Furthermore, there is no suggestion or motivation to make this combination. To establish a prima facie case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings. Second, there must also be a reasonable expectation of success for such a combination. Third, the prior art references that are combined must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). See also MPEP § 2143 - § 2143.03 for decisions pertinent to each of these criteria.

The Examiner has not demonstrated that there is any motivation in the teachings of McMillin et al. or Rohrberg, that would suggest combining the teachings of Rohrberg into the teachings of McMillin et al. to derive the present claims. Rohrberg teaches a design for a welding torch. McMillin teaches a gas injection system for plasma processing. One of ordinary skill in the art would not combine welding technology into a gas injection system for plasma processing used in semiconductor fabrication technology to derive Applicant's replaceable and shielded gas nozzle. McMillin et al. provides no teaching or suggestion that it is desirable to shield a gas nozzle within the substrate processing chamber. Rohrberg teaches shielding of an inert gas welding torch; however, the reasons for shielding an inert gas welding torch are not the same as the reasons for which Applicant's gas nozzles are shielded in the vacuum

environment of a substrate processing chamber. There's simply no motivation for combining the teachings of Rohrberg into the teachings of McMillin et al. and it is the Examiner's burden of proof to demonstrate the motivation to derive a shielded gas nozzle for such a processing chambers found in one of the cited references.

Furthermore, the Examiner acknowledges that McMillin does not teach a pinhole outlet having a diameter d_o, and wherein the distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$. This language is present in the claim, and the rejection summarily dismisses the language as merely a dimension of the apparatus. Again, the Rejection is not considering language of the claim as a whole.

Rohrberg fails to make up for the deficiencies of McMillin et al. not only because Rohrberg is non-analogous art, but also because Rohrberg does not teach that the distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$. Instead, Rohrberg teaches "A gas cup 22, which may also be of conventional design known to the prior art, is secured to holder 20 by appropriate means which may take the form of helical screw threads on both items 20 and 22 as shown by threads 24 in FIG. 1." (Rohrberg, Col. 3, lines 51-54.) Rohrberg does not teach or suggest a distance from a helical screw thread to an inlet.

Further, the Examiner continues to state that it would have been obvious based on the teachings of Rohrberg to optimize the dimensions of his apparatus. Even if Rohrberg were to optimize the dimensions of his apparatus, it is the Examiner's burden of proof to demonstrate <u>why</u> Rohrberg would have optimized his apparatus according to Applicant's invention. Where lies the motivation to perform such optimization? Why would one of ordinary skill in the art of inert gas welding apply dimensions used for a gas nozzle in semiconductor fabrication? What would motivate the person of ordinary skill in the art to perform such a dimensional change?

The Examiner gives no reason why Rohrberg would have optimized his gas nozzle to achieve the claimed "pinhole outlet having a diameter d_o, and wherein the distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$." Further, the Examiner does not explain why the claimed distance between the second external thread and pinhole outlet falling within a particular numerical ratio of the pinhole outlet diameter is a routine dimension of an apparatus.

Applicant respectfully submits that it is not a routine dimension to set a distance between the thread and the pinhole outlet diameter as a function of the outlet diameter. Applicant has discovered that the distance d_{st} should be selected to avoid adversely impacting the gas flow characteristics of the gas flowing from the pinhole outlet. For example, the pinhole outlet diameter d_o is selected to provide a pressurized flow of gas exiting the nozzle into the chamber so that the presence of the second threaded connection (to receive a heat shield) does not adversely effect the fluid dynamics of the gas flow into the chamber. For instance, a heat shield structure when attached to the second threaded connection which is behind the pinhole outlet changes the pressure gradient of gas external to the nozzle in the spatial region from the pinhole outlet to the second external thread, which in turn, affects the gas flow characteristics from the pinhole outlet. Thus, the claimed distance d_{st} is selected to provide a sufficient separation distance between the pinhole outlet and the second external thread to avoid adverse effects of the second external thread on the pinhole outlet. As claimed, the distance d_{st} is selected to be from about 90 to about 140 times d_o. This distance is not merely a dimension of the gas nozzle but an important feature that affects the gas flow characteristics of the nozzle within the substrate processing chamber which is maintained in a low-pressure vacuum environment. The inert gas welding nozzle of Rohrberg is not maintained at a low pressure or vacuum environment, and consequently, the present teachings to the position of the shield about the nozzle are not applicable to the inert gas welding nozzle of Rohrberg.

Furthermore, that the Rejection has not provided any motivation for combining McMillan et al. and Rohrberg to drive this claim limitation. McMillin et al.

clearly does not teach this ratio or that the ratio is important in substrate fabrication. In fact, McMillin et al. does not even teach that the shielding of a gas nozzle in a substrate processing chamber is desirable. Thus, clearly, one of ordinary skill in the art who is not taught shielding from the teachings of McMillin et al., would have no motivation to combine the teachings of Rohrberg into McMillin et al. to drive the present invention. This reconstruction is even more implausible when the cited second reference Rohrberg is in an entirely non-analogous art as one of ordinary skill in the art would not seek this reference for such a combination. The motivation for this combination can only be found in hindsight and based upon Applicant's own invention. A hindsight reconstruction of the invention is not a valid or permissible basis for an obviousness rejection.

It should be further noted that while Brian et al. (US 6,013,155 A) and Roderick (US 3,604,889 A) were cited by the Rejection, the Rejection did not state the reason why these references were cited. Accordingly, Applicant was unable to directly answer the Examiner's rejections based on these references.

For these reasons, claim 1 is patentable over the cited references. Dependent claims 3-8 depend on amended independent claim 1. Thus, dependent claims 3-8 are patentable over the cited references for the same reasons presented for independent claim 1.

Claims 9-11 and 13-14

Claim 9 claims a heat shield comprising a hollow member configured to be coupled with the nozzle and having an internal dimension sufficiently large to be disposed around at least a portion of the nozzle, the hollow member having an extension which projects distally of the nozzle outlet and which includes a heat shield opening for the process gas to flow therethrough from the nozzle outlet, the extension of the heat shield is sized to project distally of the nozzle outlet by a distance of between about a radius of the nozzle and about a diameter of the nozzle.

The Rejection acknowledges that "McMillin further does not teach: x. 'heat shield…wherein the extension of the heat shield is sized to project distally of McMillin's nozzle (180; Figure 1; column 6; line 66 – column 7, line 18) outlet by a distance of between about a radius of McMillin's nozzle (180; Figure 1; column 6; line 66 – column 7, line 18) and about a diameter of McMillin's nozzle (180; Figure 1; column 6; line 66 – column 7, line 18)'…"

While acknowledging that McMillin et al. does not teach this claim, the Rejection continues to reject the claim without further reason. Applicant must assume that the Rejection is relying on Rohrberg to make up for the deficiencies of McMillin et al.. However, Rohrberg fails to make up for the deficiencies of McMillin et al. because Rohrberg also does not teach that the extension of the heat shield is sized to project distally of the nozzle outlet by a distance of between about a radius of the nozzle and about a diameter of the nozzle, as recited in claim 9. Rohrberg teaches a gas cup 22 that is secured to holder 20 by appropriate means which may take the form of helical screw threads. Rohrberg does not teach or suggest a particular distance from the heat shield and the nozzle.

Consequently, neither McMillin et al. nor Rohrberg teaches the claimed language "the extension of the heat shield is sized to project distally of the nozzle outlet by a distance of between about a radius of the nozzle and about a diameter of the nozzle." Nor does the Rejection provide any reason why this claim language is not being considered. Thus, the rejection is ignoring the language of the claim as a whole.

Furthermore, the Rejection provides no explanation why the Rohrberg reference which is non-analogous art drawn to welding torches should be combined with McMillin et al. to derive the present invention. The rejection does not explain the source of the motivation to combine teachings to a cup around a welding torch as taught by Rohrberg, with a nozzle for substrate processing chamber as taught by McMillin to derive Applicant's shielded gas nozzle. As taught by the present Specification, it is

advantageous to have a heat shield which is sized to project distally of the nozzle outlet by a distance of between about a radius of the nozzle and about a diameter of the nozzle because the distance should be sufficiently large to shield the distal end of the nozzle from the heat in the chamber though not so large as to have an adverse effect on the process being performed. The teachings are not provided in either of the cited references, and the claim language as a whole is simply not taught by McMillin et al. and Rohrberg.

Therefore, claim 9 is patentable over McMillin et al. in view of Rohrberg. Dependent claims 10-11 and 13-14 depend on amended independent claim 9, and are patentable over the cited references for the same reasons.

Claims 15 and 17-20

Claim 15 is to a shielded gas nozzle comprising a longitudinal ceramic body having a channel to direct the flow of the gas into the chamber. The ceramic body comprises a first external thread to mate with the gas distributor ring and a second external thread to receive a heat shield. The channel comprises an inlet to receive the gas from the gas distributor ring, and a pinhole outlet at the end of the channel to release the gas into the chamber which has a diameter d_o. The distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$.

As acknowledged by the Examiner, "McMillin further does not teach: xiii. the shielded gas nozzle (180; Figure 1; column 6; line 66 – column 7, line 18) for a substrate processing chamber (140; Figure 1; column 6; lines 44-65) comprising (a) a longitudinal ceramic body (180; Figures 12a,b; 13a,b) having a channel (conduit not labelled [sic]; Figures 12a,b; 13a,b) to direct the flow of the gas into the chamber (140; Figure 1; column 6; lines 44-65), the ceramic body (180l; Figure 1) comprising a first external thread to mate with the gas distributor ring (170; Figure 2a,b; column 6; line 66 – column 7, line 18); a second external thread to receive a heat shield, the channel (conduit not labelled [sic]; Figures 12a,b; 13a,b) comprising an inlet to receive the gas

from he gas distributor ring (170; Figure 2a,b; column 6; line 66 – column 7, line 18), and a pinhole outlet at the end of the channel (conduit not labelled [sic]; Figures 12a,b; 13a,b) to release the gas into the chamber (140; Figure 1; column 6; lines 44-65). (b) a hollow member configured to be coupled with the ceramic body (180; Figure 1) and having an internal dimension sufficiently large to be disposed around at least a portion of the ceramic body (180; Figure 1), the hollow member having an extension which projects distally of the pinhole outlet and which includes a heat shield opening for the process gas to flow therethrough from the pinhole outlet'..." (Office Action mailed 9/14/2005, p. 6.)

Thus, the Rejection acknowledges that McMillin et al. teaches none of the elements of the claim. Applicants is not sure why McMillin et al. is being cited upon if it teaches none of the elements of the claim. Rohrberg also does not teach the elements of the claim. For example, neither McMillin et al. nor Rohrberg teaches that the distance d_{st} between the second external thread and the pinhole outlet is about $90d_0$ to about $140d_0$, as recited in amended claim 15. Rohrberg teaches a gas cup 22 secured to holder 20 by appropriate means which may take the form of helical screw threads but Rohrberg does not teach or suggest the distance from the helical screw thread to the inlet. As explained earlier, this distance is not a routine dimension of a gas nozzle. The distance d_{st} is selected to avoid impacting the characteristics of the flow of gas from the pinhole outlet by providing separation between the pinhole outlet and the second external thread to avoid adverse effects of the second external thread on the pinhole outlet, the distance d_{st} being selected to be from about 90 to about 140 times d_o. There is no motivation or suggestion in either the cited references as to why this distance would be important, or what value to assign to this distance. Further, one of ordinary skill in the art would not combine teachings to an inert gas welding torch to a gas nozzle for substrate processing chamber.

For these reasons, claim 15 is patentable over McMillin et al. in view of Rohrberg. Dependent claims 17-20 depend on amended independent claim 15 and are patentable over the cited references for the same reasons.

The above-discussed amendments are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,
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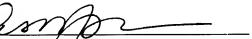
Date: October 31st, 2006 By: 

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